# Electromagnetic Physics Laboratory (EMPL)

The Electromagnetic Physics Laboratory at the Kennedy Space has developed capabilities for the study and evaluation of the electrostatic properties of films and bulk materials as well as powders and granular materials. NASA scientists in the laboratory, partnering with Swales Aerospace, Dynacs, Inc. and the Florida Institute of Technology, have been applying their expertise to enhance the research and development efforts in the electrostatics of materials. International collaborations with universities in Japan and the United States as well as with NASA's Jet Propulsion Laboratory make the EMPL a unique environment for these studies.

The Mars Electrostatics Chamber (MEC), a thermal vacuum chamber developed primarily for the simulation of the Martian environment, is also used in electrostatic studies and testing in support of the Space Shuttle and the International Space Station. This chamber is 2 meters in length, 1.3 meters in diameter, and has a volume of 1.5 $m^3$ (Fig. 1). The MEC has a vacuum depressurization time of 20 min, controlled repressurization time of 10 minutes, and can be repressurized in an emergency in 10 min. The MEC can operate at temperatures ranging from –90 ?C to 200 ?C. It has has been outfitted with an automated control system with a graphical user interface for complete automation of pressure control, atmospheric control, and temperature control.

The Triboelectric Test Robot (TTR) is an instrument recently completed in the EMPL to measure both the electrostatic generating potential and the electrostatic discharge time of films, clothing materials, space suits, solid foams, gloves, paints and coatings (Fig. 2). The TTR is capable of testing 6 samples at a time and operates in the MEC under various atmospheric gases and at atmospheric pressures ranging from 0.2 millibars to 1,000 millibars, temperatures from -90 ?C to 200 ?C, and humidities ranging form near 0% to 100%.

An advanced multisensor electrometer (Figure 3) is currently been developed to measure the surface charge deposited onto a surface by means of dust transport. This electrometer is suited to test materials exposed to powders and dusts at high speeds under various environmental conditions to measure the charge buildup as particles come in contact with it. The instrument can be used not only to test a materials response to charge accumulation but also a material's ability to keep dust adhering to it.

Besides controlling the atmospheric conditions (temperature, pressure, and gases), the EMPL has the capability to reproduce windy conditions to disperse powders and dusts onto different materials. This need derived from the inability of convection to occur at low pressures. Since convection alone cannot propel dust at low pressures (~ 1 millibar), a Dust Impeller was developed to disperse a systematic amount of dust onto a surface at speeds up to 30 m/s at low pressures (Fig. 4).

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